SPECIFICATION AMENDMENTS

Replace the paragraph beginning at page 1, line 12 with:

Under the background of high density integration of semiconductor ~~chip~~ chips, it has been increasingly popular to use a ball grid array (hereinafter referred to as BGA) type semiconductor device in which an external lead is arranged over a surface. Generally, in the BGA type semiconductor device, a printed circuit board ~~used~~ as a wiring base is popularly used. Since such a convention BGA type semiconductor device is, however, high-priced, a BGA type semiconductor device using a low-priced lead frame as a wiring base member has been practically used.

Replace the paragraph beginning at page 1, line 22 with:

A semiconductor device using a conventional lead frame as a wiring base member is hereinafter described with reference to the accompanying drawings. Fig. 11A is a sectional view showing a construction of a conventional BGA type semiconductor device disclosed in the Japanese Laid-Open Patent Publication (unexamined) No. Hei 11-74404, and Fig. 11B is a bottom view of the semiconductor device shown in Fig. 11A. Fig. 12A is a plan view showing a lead frame used in the convention BGA type semiconductor device and arranged in a single line. Fig. 12B is a sectional view taken along the line XIIb-XIIb indicated by the arrows in Fig. 12A. Fig. 12C is a sectional view taken along the line XIIc-XIIc indicated by the arrows in Fig. 12A.

Replace the paragraph beginning at page 2, line 9 with:

In Figs. 11A, 11B, 12A, 12B and 12C, the conventional BGA type semiconductor device uses a lead frame 50 as a wiring base member, and a semiconductor chip 1 provided with a pad electrode is mounted on a die pad 2 ~~through~~ with a junction material 3. The semiconductor device has a ~~soldering~~ solder ball mounting portion (hereinafter referred to as external electrode portion) 4. A lead electrode 5, of which an inside end portion is radially arranged ~~around~~ the die pad 2, and a pad electrode of the semiconductor chip 1 are connected to each other through a connection lead 6 and sealed with a ~~seal~~ resin layer 7. Portions 4a and 4b continued underneath the lead electrode 5 are ~~formed~~ made thin by etching except the external electrode portion 4. Accordingly, the die pad 2, the external electrode portion 4 and a suspension lead 8 for supporting the die pad 2 are exposed on the same surface as the under

surface of the seal resin layer 7. A ~~soldering~~ solder ball 9 is mounted on the external electrode portion 4, and an end of the lead electrode 5 and that of the suspension lead 8 are finally cut along the resin seal line 7a.

Replace the paragraph beginning at page 3, line 3 with:

A manufacturing method is hereinafter described with reference to Figs. 11 to 13. Figs. 13A, 13B and 13C are explanatory views showing a manufacturing method of the conventional BGA type semiconductor device. Fig. 13A is a sectional view of the lead frame shown in Fig. 12C. Fig. 13B is a sectional view showing ~~a stat that~~ molds ~~are~~ applied at the time of sealing with the seal resin layer. Fig. 13C is a sectional view showing ~~a state that~~ an assembling step before mounting of the soldering ball has been completed.

Replace the paragraph beginning at page 3, line 12 with:

First, the lead frame 50 shown in Figs. 12A, 12B and 12C is manufactured. More specifically, after forming a resist film ~~not shown~~ on the upper surface 50a and the under surface 50b of the lead frame 50 and patterning it, as shown in Fig. 12A ~~an etching~~ the lead frame is ~~applied~~ etched from the upper surface 50a and the under surface 50b. Thus, the die pad 2, the external electrode portion 4, the lead electrode 5, the suspension lead 8 and a dam bar 50c are formed to ~~be continued on another~~ continue across openings 50d and 50e. Then, after forming a resist film ~~not shown to~~ on the under surface 50b ~~side~~ of the lead frame 50, except the portions 4a and 4b on the underside of the lead electrode 5, the portions 4a and 4b are formed by ~~applying~~ half etching.

Replace the paragraph beginning at page 3, line 24 with:

Subsequently, the semiconductor chip 1 provided with the pad electrode is mounted on the die pad 2 by applying the junction material 3. The pad electrode of the semiconductor chip 1 and the inside end of the electrode 5 are then connected through the connection lead 6. Then, as shown in Fig. 13B, after mounting a lower mold 10 in contact with the die pad 2 and the external electrode portion 4, an upper mold 11 is positioned ~~to~~ on the resin seal line 7A and mounted on the upper surface of the lead frame 50. After tightening the two molds 10 and 11, the semiconductor chip 1, the die pad 2, the lead electrode 5 and the connecting lead 6 are sealed with the seal resin layer 7 by transfer molding. Thereafter, when removing the

upper mold 11 and the lower mold 10, a non lead type semiconductor device, before mounting the ~~soldering~~ solder ball 9, is obtained as shown in Fig. 13C.

Replace the paragraph beginning at page 4, line 14 with:

Then, by applying ~~a~~ soldering paste to the external electrode portion 4, the ~~soldering~~ solder ball 9 is mounted on the external electrode potion 4. When the lead electrode 5 protruding from the resin sealing line 7a ~~to outside off~~, and the seal resin layer 7 getting into the underside portions 4a and 4b of the lead electrode 5 ~~formed~~, made thin by half etching, are cut along the resin seal line 7a with a cutter, the conventional BGA type semiconductor device shown in Figs. 11A and 11B is obtained.

Replace the paragraph beginning at page 4, line 23 with:

In the mentioned semiconductor device using the conventional lead frame as the wiring base member, since the die pad 2, the external electrode portion 4, the lead electrode 5, the suspension lead 8 and dam bar 50c ~~are formed to be continued on another~~ continue across the openings 50d and 50e, when sealed with the seal resin layer 7 after mounting the two molds 10 and 11, the ~~seal~~ molten resin ~~layer 7 molten to have~~, having a low viscosity, ~~is formed~~ also ~~in~~ flows into the opening portion 50d. As a result, there has been a problem that the ~~resin~~ molten ~~to have a low viscosity~~ resin intrudes into a small space between contact surfaces, where the die pad 2, the external electrode portion 4, the suspension lead 8 are in contact with the lower mold 10, and comes to form a thin resin film (hereinafter referred to as thin burr).

Replace the paragraph beginning at page 5, line 11 with:

It is certainly possible to prevent the formation of the thin burr ~~formed~~ between the external electrode portion 4 and the lower mold 10 if ~~a~~ contact pressure between the external electrode portion 4 and the lower mold 10 is large. However, the lead electrode 5 is ~~formed~~ made thin by etching and supported like a cantilever at a part held between the lower mold 10 and the upper mold 11 at the position of the resin seal line 7a. Therefore, if the external electrode portion 4 is pressed by the lower mold 10, the lead electrode 5 is deformed by the pressure. As a result, it has been heretofore impossible to secure ~~a~~ contact pressure ~~capable~~

~~of~~ preventing the formation of the thin burr between the external electrode portion 4 and the lower mold 10.

Replace the paragraph beginning at page 5, line 24 with:

The formation of the thin burr varies depending on the degree of roughness in surface finishing (hereinafter referred to as surface roughness) of the contact surface where the die pad 2 and the external electrode portion 4 are in contact with the lower mold 10. Generally, the thin burr does not adhere to any die or mold ~~of a~~ having good surface roughness, but adheres to the die pad 2, the external electrode portion 4, etc. ~~of a bad~~ having poor surface roughness. Therefore, it is necessary to remove the thin burr adhered, for example, to the external electrode portion 4. To remove the thin burr, hydraulic pressure trimming, chemical trimming, chemical and hydraulic pressure trimming, etc. are performed, and after removing the thin burr, it is necessary to perform treatments such as washing, drying, etc., and as a result manufacturing cost is high.

Replace the paragraph beginning at page 6, line 13 with:

There has been another problem ~~that~~ with the lead electrode 5 protruding from the resin seal line 7a ~~to outside~~, the seal resin layer 7 ~~getting in~~ gets into the portions 4a and 4b ~~formed~~ made thin by half etching, and the suspension lead 8~~, are~~ is cut using a cutter along the resin seal line 7a. Therefore, it is easy to ~~occur~~ cause a failure in cutting the portion of the seal resin layer 7 ~~getting~~ in the portion 4b. As a result, the resin seal line 7a is not linear but ~~formed into~~ has a complicated crushed configuration, resulting in a defective product.

Replace the paragraph beginning at page 6, line 22 with:

Moreover, as the semiconductor chip 1, the die pad 2, the junction material 3, the lead electrode 5 and the seal resin layer 7 forming the semiconductor device are different in their coefficient of linear expansion, so a curvature is produced due to thermal deformation at the time of manufacturing the semiconductor device.

Replace the paragraph beginning at page 7, line 3 with:

As a result, there has been a further problem when the non lead type semiconductor device is mounted on an other board, the external electrode portion is inclined and any desirable contact surface is not achieved in the electrical connection with the other board.

Replace the paragraph beginning at page 19, line 18 with:

Configuration of a lead frame 60 is hereafter described. As shown in Figs. 2A, 2B and 2C, the lead frame 60 is composed of a conductive plate-like body such as copper and having an ~~uneven~~ non planar upper surface 60a and a ~~plain~~ planar under surface 60b. This plate-like body includes a first thin portion 60c for mounting a semiconductor chip 21 provided with a plurality of pad electrodes ~~not shown~~, a plurality of first thick portions 60d ~~provided~~ radially arranged around the first thin portion 60c for forming lead electrodes 23 respectively ~~arranged~~ corresponding to the pad electrodes of the semiconductor chip 21, a second thin portion 60e provided between ~~one~~ pairs of the plurality of first thick portions 60d ~~and another~~, a third thin portion 60f ~~provided for~~ surrounding the plurality of first thick portions 60d, a second thick portion 60g ~~provided around~~ surrounding the third portion 60f. Further, the first thin portion 60c, the second thin portion 60e and the third thin portion 60f have substantially the same thickness. Those thin portions 60c, 60e and 60f form a concave part 60h having a peripheral portion 60i. The thick portions 60d and 60g form a projecting part.

Replace the paragraph beginning at page 20, line 12 with:

Using such a lead frame 60, a semiconductor device 20 shown in Figs. 1A and 1B is obtained. The semiconductor device 20 has an upper surface 21a and an under surface 21b, and ~~in which~~ the semiconductor chip 21 having the plurality of pad electrodes ~~not shown~~ is mounted on the first thin portion 60c of the lead frame 60 ~~not shown through~~ with a junction member 22. The plurality of lead electrodes 23 extending peripherally on the under surface 21b side of the semiconductor chip 21 ~~are arranged corresponding~~ correspond to the plurality of pad electrodes. A connecting lead 24 serving as connecting means makes a connection between the plurality of pad electrodes and the plurality of lead electrodes 23. Each of the plurality of lead electrodes 23 includes a thin internal lead portion 23a having a connection

part ~~to~~ for the connecting lead 24 on the upper surface side, and a thick external electrode portion 23b protruding toward the under surface and forming a connection part to outside.

Replace the paragraph beginning at page 21, line 18 with:

Now, a method of manufacturing the semiconductor device is described with reference to Figs. 1A to 3E. Figs. 3A to 3E are explanatory views showing a manufacturing method of the semiconductor device according to the first preferred embodiment of the present invention. Fig. 3A is a sectional view showing ~~a state that~~ a semiconductor chip mounted on the lead frame formed with a thin portion and a lead electrode ~~is~~ electrically connected to the lead electrode. Fig. 3B is a sectional view showing ~~a state that~~ an upper mold and a lower mold ~~are~~ applied to seal with a resin layer. Fig. 3C is a sectional view showing ~~a state that~~ a resist film for etching ~~is~~ applied to form an external electrode portion. Fig. 3D is a sectional view showing ~~a state that~~ the external electrode portion ~~is protruded~~ made protruding by etching. Fig. 3E is a sectional view showing ~~a state that~~ a conductive ball ~~is~~ mounted on the external electrode portion.

Replace the paragraph beginning at page 22, line 9 with:

First, by ~~applying a~~ half etching ~~to~~ the upper surface 60a of the lead frame 60, after forming a resist film not shown and patterning it as shown in Fig. 2A, a plate-like body provided with the ~~uneven~~ non-planar upper surface 60a and the ~~plain~~ planar, under surface 60b is formed. More specifically, the first thin portion 60c for mounting the semiconductor chip 21 provided with the plurality of pad electrodes ~~not shown~~, the plurality of first thick portions 60d ~~provided~~ radially arranged around the first thin portion 60c for forming the lead electrodes 23 respectively ~~arranged~~ corresponding to the pad electrodes of the semiconductor chip 21, the second thin portion 60e provided between ~~one~~ pairs of the plurality of first thick portions 60d ~~and another~~, the third thin portion 60f ~~provided for~~ peripherally surrounding the plurality of first thick portions 60d, and the second thick portion 60g ~~provided around~~ surrounding the third thin portion 60f are formed.

Replace the paragraph beginning at page 22, line 25 with:

Further, the first thin portion 60c, the second thin portion 60e and the third thin portion 60f have substantially the same thickness, and those thin portions 60c, 60e and 60f

form the concave part 60h. ~~And, the~~ The thick portions 60d and 60g form the projecting part. Thus, the plate-like body provided with the ~~uneven~~ non-planar upper surface 60a and the ~~plain~~ planar under surface 60b is formed.

Replace the paragraph beginning at page 23, line 7 with:

In the sectional form of the peripheral portion 60i of the concave part 60h formed in the direction of thickness by etching, a smooth ~~draft~~ surface is naturally formed, spreading out a little from the third thin portion 60f toward the upper surface 60a of the lead frame due to side etching peculiar to this etching. As a result, it becomes easy to separate the peripheral portion 25b of a later-described seal resin layer 25 from the peripheral portion 60i of the concave part 60h of the lead frame 60.

Replace the paragraph beginning at page 23, line 16 with:

The peripheral portion 60i may be ~~formed~~ either ~~to be~~ larger than a resin seal line 25a, for example, ~~to be~~ larger by a depth of the concave part 60h or ~~to be~~ coincident with the resin seal line 25a, so that a later-described upper mold 31 is easily positioned.

Replace the paragraph beginning at page 23, line 21 with:

Then, as shown in Fig. 3A, by applying a junction material 22 composed of epoxy resin, epoxy resin with silver, adhesive tape, solder or the like to the central part of the first thin portion 60c, the semiconductor chip 21 is ~~put together~~ mounted (junction step).

Replace the paragraph beginning at page 24, line 4 with:

Then, as shown in Fig. 3B, the under surface 60b of the lead frame 60 ~~of~~ for which the junction step and the connection step have been completed is mounted on the lower mold 30. Then, the upper mold 31 is positioned to the resin seal line 25a and mounted on the upper surface 60a of the lead frame 60. After tightening the two molds 30 and 31, the thermosetting seal resin layer 25 composed of epoxy resin, phenol resin or the like is transformed to a liquid of a low viscosity and injected with a high pressure by transfer molding (sealing step).

Replace the paragraph beginning at page 24, line 13 with:

At this time, the under surface 60b side of the lead frame 60 being integrated with the thin portions 60c, 60e and 60f comes entirely in contact with the lower mold 30, and the seal resin layer 25 is ~~shut off~~ blocked by the thin portions 60c, 60e and 60f. Therefore, the seal resin layer 25 does not flow in the contact surface between the under surface 60b of the lead frame 60 and the lower mold 30. As a result, it is possible to prevent ~~a~~ formation of a thin burr.

Replace the paragraph beginning at page 24, line 21 with:

After the sealing step, the two molds 30 and 31 are removed. ~~And as~~ As shown in Fig. 3C, on the under surface 60b of the lead frame 60, ~~a masking with~~ a resist film 32 is applied to a part where the external electrode portion 23b is formed and to a part surrounding the outside of the peripheral portion 60i of the concave part 60h. Then the under surface 60b of the lead frame 60, except the portions ~~applied~~ covered with the resin film 32, is removed by half etching up to the same surface as the under surface of the seal resin layer 25. As a result, as shown in Fig. 3D, the junction material 22 is exposed, and the plurality of lead electrodes 23 protrude respectively toward the under surface. Thus, the thick external electrode portion 23b serving as a connection part ~~to outside~~ is formed on the underside of the lead electrodes 23 (formation step of external electrode portion).

Replace the paragraph beginning at page 25, line 22 with:

Under such a condition, by pushing the semiconductor device 20 in the direction of arrow (A) shown in Fig. 3D, the semiconductor device 20 is separated from the lead frame 60 (separation step). As a result, it is possible to separate easily the semiconductor device 20 and the lead frame 60 without using any cutter, and it is further possible to prevent the separated portion of the seal resin layer 25 of the semiconductor device 20 from ~~being~~ having a complicated crushed configuration.

Replace the paragraph beginning at page 26, line 9 with:

Further, the semiconductor device obtained after this separation step can be ~~built~~ used in a thin and small apparatus such as cellular phone to serve as a non lead type semiconductor device.

Replace the paragraph beginning at page 26, line 13 with:

Further, before the separation step, as shown in Fig. 3E, a soldering paste is applied to the external electrode portion 23b ~~not shown~~ to connect a conductive ball 26, such as soldering ball. Thereafter, by pushing the semiconductor device 20 in the direction of the arrow (A) at the part where the semiconductor device 20 and the peripheral portion 60i of the lead frame 60 are connected, the semiconductor device 20 is separated from the lead frame 60. Thus, a BGA type semiconductor device as shown in Figs. 1A and 1B is obtained.

Replace the paragraph beginning at page 26, line 22 with:

That is, in this manufacturing method, as a result of using the lead frame 60 as a wiring base member, it is possible to achieve the BGA type semiconductor device by adding the step of mounting the conductive ball before the separation step for obtaining the non lead type semiconductor device. This means that both non lead type semiconductor device and BGA type semiconductor device are obtained in ~~the~~ a common manufacturing process, thus it is possible to establish an efficient manufacturing line.

Replace the paragraph beginning at page 27, line 6 with:

On the under surface side of the semiconductor device 20, the external electrode 23b protrudes downward from the underside of the seal resin layer 25. Therefore, even if a curvature is produced due to difference in ~~coefficient~~ coefficients of thermal expansion of the components of the semiconductor device, it is possible to obtain a desirable contact surface in the electrical connection between the external electrode portion 23b and other board.

Replace the paragraph beginning at page 27, line 14 with:

Even if there is a curvature in the other board, in addition to the curvature produced in the semiconductor device 20 itself, the external electrode portion 23b comes exactly ~~in~~ into

contact with the other board without fail, and there is no insufficient contact. As a result, when incorporating the non lead type semiconductor device in a cellular phone in which the size of semiconductor device is ~~essentially~~ required to be small, it becomes possible to ~~thin~~ reduce the diameter of soldering ball by 0.45 mm, for example.

Replace the paragraph beginning at page 28, line 4 with:

Though an example in which one semiconductor chip 20 is mounted on the lead frame 60 and the lead electrodes 23 are arranged around it, and a plurality of such lead frames are arranged in a single line is described in this embodiment, it is also preferable that, from the viewpoint of efficient manufacture, a plurality of semiconductor chips 21 are mounted in several rows and ~~trains~~ columns as shown in Figs. 4A and 4B. In such a modification, the same function and advantage as the foregoing are also exhibited.

Replace the paragraph beginning at page 28, line 13 with:

To obtain a so-called multi-~~tip~~chip-package semiconductor device in which two semiconductor chips having the same function and heating value are simultaneously sealed with one resin, it is also preferable that a periphery 601 of the concave part 60h ~~is~~ be provided as indicated by one-dot line in Fig. 4A to use a lead frame having a sectional view shown in Fig. 4C. In such a modification, the same function and advantage as the foregoing are also exhibited.

Replace the paragraph beginning at page 28, line 21 with:

To obtain a so-called multi-~~tip~~chip-package semiconductor device in which a semiconductor chip for power ~~of~~ with a high heating value and another semiconductor chip ~~of~~ with a small heating value are simultaneously sealed with one resin, as shown in Figs. 5A and 5B, it is also preferable that a radiation member 61 ~~is~~ be provided in the region where the semiconductor chip for power of a high heating value is mounted. In such a modification, the same function and advantage as the foregoing are also exhibited.